NAVY ENVIRONMENTAL HEALTH CENTER
FUELS COMPARISON CHART

	JP-8	Jet A	JP-5	JP-4	Regular Gasoline, Unleaded
USES	*DOD Jet Fuel since 1991, used predominately by the Army and the Air Force to power aircrafts and land vehicles. Also now used by the Navy at land based activities.	Commercial Airline Jet Fuel	Jet Fuel used aboard ships, Navy vehicles and equipment from about 1952.	DOD Jet Fuel from 1951. Was phased out beginning in 1991 and completely in 1996. Used to power Navy aircrafts and Marine Corps land vehicles.	Used in commercial automobiles by the general public.
SPECIFICATION**	MIL-T-83133	ASTM D 1655	MIL-T-5624	MIL-T-5624	ASTM D 4814
Primary Constituents (typically > 98% total volume)- All petroleum products are made from *crude oil*. Crude oil contains primarily hydrocarbon compounds made up of mostly carbon and hydrogen. In hydrocarbon compounds, the carbon atoms link together in chains of different carbon lengths. In a refinery, these chains are separated by heating (distillation). The crude oil is heated and the different compounds separate into groups based on their boiling points and density. The boiling point and density ranges of these groups are also related to the number of linked carbons the individual compounds contain. *Gasoline* is a blend of some of the shorter chain molecules that boil off first in the refining process. The chain lengths range from four to twelve, C4 – C12. *Kerosene* contains more of the middle distillate, or middle boiling point compounds in the C6 to C18 range. Kerosene is followed by *diesel fuel* and heavier fuel oils (like heating oil for houses) that contain longer chain compounds. Gasoline typically contains more benzene and higher amounts of aromatic (benzene containing compounds) than the kerosene based jet fuels. Crude oil composition varies depending on its source.					
	> 98 % Kerosene containing compounds in the C7 through C18 range	> 98% Kerosene containing compounds in the C7 through C18 range	> 98% Specially blended Kerosene containing compounds in the C8 through C17 range	> 98% Mixture of 65% Gasoline and 35% Petroleum Distillates – mixture contains compounds in the C5 through C14 range	> 98% Refined Petroleum Hydrocarbon containing compounds in the C4 through C12 range
Additives (combined typically < 2% total volume) - Additives are used in Jet Fuel to improve its performance under varying conditions. Typical additives to Jet Fuels and Gasoline include antioxidants, metal deactivators, static dissipator, corrosion inhibitors, fuel system icing inhibitors, octane enhancers, ignition controllers, and detergents/dispersants. These additives are used only in specified amounts, as governed by the military (MIL) and or commercial (ASTM) specification. The specification will decide which additives are required and which may be **OPTIONAL**. Whether an additive is optional or required, if it is added, it must be chosen from one of the chemical listed below. The chemicals listed below for each additive are not all used at once but represent the lists from which to choose.					
ANTIOXIDANT[1]	**OPTIONAL may contain one or more of the following:** • 2,6-di-tert-butyl-4-methylphenol • 2,6-di-tert-butylphenol • 2,4-dimethyl-6-tert-butylphenol • 75% min-2,6-di-tert-butylphenol 25% max tert-butylphenols and tri-tert-butylphenols • 72% min 2,4-dimethy-6-tert-butylphenol 28% max tert-butyl-methylphenols and tert-butyl-dimethylphenols • 55% min 2,4-dimethyl-6-tert-butylphenol 15% min 2,6-di-tert-butyl-4-methylphenol 30% max mixed methyl and dimethyl tert-butylphenols	**OPTIONAL may contain one or more of the following:** • 2,6-di-tert butyl-4-methyl phenol • 2,6-di-tert butyl phenol • 2,4-dimethyl-6-tert-butylphenol • 75% min-2,6-di-tert-butylphenol 25% max mix tert-butylphenols and tri-tert-butylphenols • 72% min 2,4-dimethyl-6-tert-butyl phenol 28% max tert-butyl-methylphenols and tert-butyl-dimethylphenols • 55% min 2,4-dimethyl-6-tert-butylphenol 15% min 2,6-di-tert-butyl-4-methylphenol remainder: monomethyl and dimethyl tert- butylphenols	**REQUIRED contains one or more of the following:** • 2,6-di-tert-butyl-4-methylphenol • 2,6-di-tert-butylphenol • 2,4-dimethyl-6-tert-butylphenol • 75% min-2,6-di-tert-butylphenol 25% max tert-butylphenols and tri-tert-butylphenols • 72% min 2,4-dimethy-6-tert-butylphenol 28% max tert-butyl-methylphenols and tert-butyl-dimethylphenols • 55% min 2,4-dimethyl-6-tert-butylphenol 15% min 2,6-di-tert-butyl-4-methylphenol 30% max mixed methyl and dimethyl tert-butylphenols	**OPTIONAL may contain one or more of the following:** • 2,6-di-tert-butyl-4-methylphenol • 6-tert-butyl-2,4-dimethylphenol • 2,6-di-tert-butylphenol • 75% min-2,6-di-tert-butylphenol 25% max tert-butylphenols and tri-tert-butylphenols • 72% min 6-tert-butyl-2,4-dimethyphenol 28% max tert-butyl-methylphenols and tert-butyl-dimethylphenols • 55% min 2,4-dimethyl-6-tert-butylphenol 15% min 2,6-di-tert-butyl-4-methylphenol 30% max mixed methyl and dimethyl tert- butylphenols	**REQUIRED contains one or more of the following:** • N,N-dialkylphenylenediamines • 2,6-dialkylphenols • 2,4,6-trialkylphenols • butylated methyl phenols • butylated ethyl phenols • butylated dimethyl phenols • triethylene tetramine di(monononylphenolate)

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METAL DEACTIVATOR[2]	**OPTIONAL** N,N-disalycylidene-1,2-propanediamine	**OPTIONAL** N,N-disalycylidene-1,2-propanediamine	NOT USED	**OPTIONAL** N,N-disalycylidene-1,2-propanediamine	**REQUIRED contains one or more of the following:** • N,N-disalicylidene-1,2-ethanediamine • N,N- disalicylidene-propanediamine • N,N- disalicylidene- • Cyclohexanediamine • Disalicylidene-N-methyl dipropylene triamine
STATIC DISSIPATOR[3]	**REQUIRED** Stadis 450 containing: • 50-65% Toluene • <1% Benzene • 5-10% Heavy Aromatic Naptha • <5 % Isopropyl Alcohol • 1-10% Dodecylbenzenesulfonic Acid • 10-20% Trade secret • 1-10% Trade secret	**OPTIONAL** Stadis 450 containing: • 50-65% Toluene • <1% Benzene • 5-10% Heavy Aromatic Naptha • <5 % Isopropyl Alcohol • 1-10% Dodecylbenzenesulfonic Acid • 10-20% Trade secret • 1-10% Trade secret	NOT USED	**REQUIRED** Stadis 450 cotaining: • 50-65% Toluene • <1% Benzene • 5-10% Heavy Aromatic Naptha • <5 % Isopropyl Alcohol • 1-10% Dodecylbenzenesulfonic Acid • 10-20% Trade secret • 1-10% Trade secret	NOT USED
CORROSION INHIBITOR[4]	**REQUIRED** Organic Acid	NOT USED	**REQUIRED** Organic Acid	**REQUIRED** Organic Acid	**REQUIRED contains one or more of the following:** • Organic acids • Phosphoric acids • Sulfonic acids
FUEL SYSTEM ICING INHIBITOR[5]	**REQUIRED** Diethylene glycol monomethyl ether and 50 to 150 ppm by weight of either • 2,6-ditert-butyl-4-methylphenol • 2,4 dimethyl, 6-tert-butyl-2,4-dimethylphenol • 2,6-di-tert-butylphenol • 75% min-2,6-di-tert-butylphenol 25% max tert-butylphenols and tri-tert-butylphenols	**OPTIONAL** Diethylene glycol monomethyl ether 0.10 – 0.15%	**REQUIRED** Diethylene glycol monomethyl ether and 50 to 150 ppm by weight of either • 2,6-ditert-butyl-4-methylphenol • 2,4 dimethyl, 6-tert-butyl-2,4-dimethylphenol • 2,6-di-tert-butylphenol • 75% min-2,6-di-tert-butylphenol 25% max tert-butylphenols and tri-tert-butylphenols	**REQUIRED** Diethylene glycol monomethyl ether and 50 to 150 ppm by weight of either • 2,6-ditert-butyl-4-methylphenol • 2,4 dimethyl, 6-tert-butyl-2,4-dimethylphenol • 2,6-di-tert-butylphenol • 75% min-2,6-di-tert-butylphenol 25% max tert-butylphenols and tri-tert-butylphenols	**REQUIRED** Isopropyl alcohol
OCTANE ENHANCER[6]	NOT USED	NOT USED	NOT USED	NOT USED	**REQUIRED contains one or more of the following:** • Methyl t-butyl ether • t-butyl alcohol • ethanol • methanol
IGNITION CONTROLLERS[7]	NOT USED	NOT USED	NOT USED	NOT USED	**REQUIRED** Tri-o-cresylphosphate

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DETERGENTS/ DISPERSANTS[8]	NOT USED	NOT USED	NOT USED	NOT USED	**REQUIRED contains one or more of the following:** • Alkylamine phosphates • Poly-isobutene amines • Long chain alkyl phenols • Long chain carboxylic acids • Long chain amines

* DOD switched from JP-4 to JP-8 because it is safer to use. JP-8 has a higher flash point and lower vapor pressure, which makes it less likely for an aircraft to explode if damaged in combat. Also, because of its lower volatility, less volatile organic compounds (VOCs) are released into the atmosphere preventing pollution. In 1997, the Defense Energy Support Center (DESC) completed a comprehensive air emission survey of the DoD bulk petroleum storage infrastructure. The purpose of the survey was to quantify the reduction in emissions of VOCs resulting from the conversion from JP-4 to JP-8 jet fuel. The study considered all DoD bulk petroleum storage facilities subject to the pollution prevention goals established by the President pursuant to Executive Order 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements. The study identified approximately 210 installations with a total of 1,880 tanks. The study found that from FY 92 to FY 97 annual emissions of VOCs at DoD facilities subject to the requirements of E.O. 12856 decreased from 858,000 lb/yr. to less than 100,000 lb/yr. Although emissions from loading operations were not calculated, we would expect a similar decrease in VOC emissions from these sources also.

** Specifications define the required results, but do not mandate the method(s) for achieving the results.
"MIL" indicates a Military Specification standard for products used in the military.
"ASTM" (American Society for Testing and Materials) indicates a Commercial technical specification standard.

ADDITIVES

1. Antioxidants prevent the formation of deposits in aircraft engine fuel systems.
2. Metal deactivators suppress fuel oxidation.
3. Static dissipator is used primarily to reduce the hazardous effects of static electricity generated by movement of fuel through high flow-rate fuel transfer system.
4. Corrosion inhibitors protect metals from corrosion in fuel handling systems.
5. Icing inhibitors prevent any water in the fuel tank from freezing at high altitudes.
6. Octane enhancer provides a more complete and thorough burn of fuel mixture.
7. Ignition controller is used as a lubricant in the ignition system.
8. Detergents/dispersants remove and prevent deposits such as carbon in the engine's intake system.